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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/517,818	12/14/2004	Suk Hun Lee	3449-0413PUS1	8713
2292 7590 06/01/2007 BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747			EXAMINER INGHAM, JOHN C	
			ART UNIT 2814	PAPER NUMBER
			NOTIFICATION DATE 06/01/2007	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary

Application No.

10/517,818

Applicant(s)

LEE, SUK HUN

Examiner

John C. Ingham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 February 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 September 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The amendments to the claims, filed 23 March 2007 have been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims **21-23, 27-28, 31 and 35-38** are rejected under 35 U.S.C. 102(b) as being anticipated by Takashi (IDS filed 27 September 2006, JP 20010274096, English translation made of record 27 November 2006).
4. Regarding claims **21, 27 and 31**, Takashi discloses in the abstract figure a nitride semiconductor LED, comprising: a substrate (1); a buffer layer (2, 3 and 30) formed on the substrate; an undoped GaN layer (4) on the buffer layer; AlGaIn/GaN short period superlattice layers (40 and 50, may be AlGaIn/GaN as described in ¶11) formed on the undoped GaN layer (4) in a sandwich structure of upper and lower layers having an undoped GaN layer (5) interposed therebetween; a first electrode layer of an n+ GaN layer (6, 7 contact layers are highly doped for conductivity) formed above and in direct contact with the upper SPS layer; an n-GaN layer (10) formed on the first electrode

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layer and containing a low concentration of dopants (guide layers doped lower for bandgap); an active layer (11) formed on the first electrode layer; and a second electrode layer (15) of p-GaN layer formed on the active layer.

5. Regarding claims **22, 28 and 32**, Takashi discloses the LED of claims 21 and 27 wherein the GaN buffer layer (2, 3 and 30) has a triple-structured AlGa_xN/InGa_{1-x}N/GaN laminated (¶52).

6. Regarding claim **23**, Takashi discloses the LED of claim 21, further comprising the undoped GaN layer (4) on the GaN based buffer layer (2, 3 and 30).

7. Regarding claims **35-36 and 38**, Takashi discloses a fabrication method of a nitride semiconductor LED, comprising: forming a GaN-based buffer layer (¶51, item 2, 3 and 30) on a substrate; forming an undoped GaN layer (4) on the buffer layer; forming Al_yGa_{1-y}N/GaN short period superlattice layers (40, 50) on the GaN based buffer layer in a sandwich structure of upper and lower layers having an undoped GaN layer (5) interposed therebetween (¶54); forming a first n type GaN based layer (6, 7) above and in direct contact with the upper SPS layer; forming an n-GaN layer (10) containing a low concentration of dopants between the first GaN based layer of a n+ GaN layer (7) and the active layer; forming an active layer (¶84, item 11) on the first GaN based layer; and forming a second GaN based layer (15) of a p-GaN layer on the active layer (¶86).

8. Regarding claim **37**, Takashi discloses the fabrication method of claim 35, wherein the GaN buffer layer (2, 3 and 30) has a triple-structured AlGa_xN/InGa_{1-x}N/GaN laminated (¶52).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims **24-26** are rejected under 35 U.S.C. 103(a) as being unpatentable over Takashi.

11. Regarding claim **24**, Takashi discloses in the abstract figure a nitride semiconductor LED, comprising: a substrate (1); a buffer layer (2, 3 and 30) formed on the substrate; an undoped GaN layer (4) on the buffer layer; AlGaIn/GaN short period superlattice layers (40 and 50, may be AlGaIn/GaN as described in ¶11) formed on the undoped GaN layer (4) in a sandwich structure of upper and lower layers having an undoped GaN layer (5) interposed therebetween; a first GaN based layer (6 and 7) above and in direct contact with the upper SPS layer (50); an n-GaN layer (10); an active layer (11) formed on the first electrode layer; and a second GaN based layer (15) of p-GaN formed on the active layer. GaN layers (6 and 7) are considered integral because they are of the same material (layer 7 is grown on layer 6 so even the lattice constants match) and of the same conductivity (layer 6 is undoped GaN, which is generally UID n-type, see Edmond US 6,800,876 col 7 ln 24).

Takashi does not disclose that the active layer is in direct contact with the first GaN layer. Instead Takashi shows a crack prevention layer (8), a cladding layer (9), and a guide layer (10) between the active layer and the first GaN layer. However, the

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omission of elements would have been obvious to one of ordinary skill in the art at the time of the invention if the function of the elements was not desired (MPEP 2144.04). It is well known in the art that crack prevention layers, cladding layers, and guide layers are not required layers for light emitting devices (see Yuasa US 6,017,774 Fig 4) and their omission would lead the active layer to be in direct contact with the first GaN based layer.

12. Regarding claim **25**, Takashi discloses the LED of claim 24, wherein the GaN buffer layer (2, 3 and 30) has a triple-structured AlGaIn/InGaIn/GaN laminated ($\text{¶}52$).

13. Regarding claim **26**, Takashi discloses the LED of claim 24, further comprising the undoped GaN layer (4) on the GaN based buffer layer (2, 3 and 30).

14. Claims **29-30, 33-34 and 40** are rejected under 35 U.S.C. 103(a) as being unpatentable over Takashi and Koide. Takashi discloses the LED of claims 27 and 31, and the method of claim 35, but does not specify wherein the dopant concentration of the n+ GaN layer (first GaN based layer, item 7) is more than $1 \times 10^{18}/\text{cm}^3$ or wherein the dopant concentration of the n-GaN layer (10) is $1 \times 10^{17}/\text{cm}^3$.

Koide teaches that the dopant concentration of the n+ GaN contact layer in an LED is more than $1 \times 10^{18}/\text{cm}^3$ ($\text{¶}48$) and the dopant concentration of the n-GaN clad layer is approximately $1 \times 10^{17}/\text{cm}^3$ ($\text{¶}48$). It would have been obvious to one of ordinary skill in the art at the time of the invention to use these values since these values are well known in the art. The high dopant concentration is known and improves conductivity of the n+ GaN contact layer, while the low dopant concentration is also known and

improves the band gap of the n- GaN clad layer (e.g. Hatano col 8 In 20 describes dopant relationship to resistance in LEDs).

15. Claim **39** is rejected under 35 U.S.C. 103(a) as being unpatentable over Takashi in view of Yuasa (US 6,017,774). Takashi discloses the method of claim 35, wherein the layers are grown to a 50-400Å thickness (¶34) at 800°C (¶70), but does not specify that the GaN buffer layer is formed using MOCVD equipment in an atmosphere having H₂ and N₂ carrier gases supplied while having TMGa, TMI_n, TMAI source gas introduced and simultaneously having NH₃ gas introduced.

Yuasa teaches the formation of nitride films using MOCVD equipment at a growth temperature of 800°C (col 13 In 66) in an atmosphere of H₂ and N₂ carrier gases supplied while TMGa and NH₃ are introduced simultaneously (col 13 In 33). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Yuasa on the method of Emerson since the teachings produce a nitride film with good growth efficiency relative to the material supply amount (col 10 In 20-23).

Response to Arguments

16. Applicant's arguments filed 27 February 2007 have been fully considered but they are not persuasive. Regarding the argument on page 11 that there is an additional undoped GaN layer (6) between the layer 7 and the SPS layer 50, the layers 6 and 7 are considered integral because they are both GaN. Further, layer 7 is grown on layer 6, so that even the lattice constant are matched (¶84). Finally, undoped GaN layer 6 is

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generally n-type as is layer 7. Regarding the argument that Takashi's SPS does not include an undoped GaN layer – layer 5 is between SPS items 40 and 50, and is undoped.

Conclusion

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

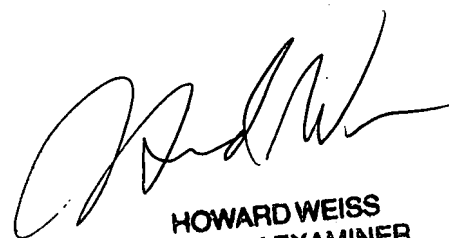
Any inquiry concerning this communication or earlier communications from the examiner should be directed to John C. Ingham whose telephone number is (571) 272-8793. The examiner can normally be reached on M-F, 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

John C Ingham
Examiner
Art Unit 2814

jci



HOWARD WEISS
PRIMARY EXAMINER